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Preservation of Ultra Low Emittances in Future High Energy Plasma Wakefield-based Colliders¹ REZA GHOLIZADEH, TOM KATSOULEAS, PATRIC MUGGLI, University of Southern California, WARREN MORI, University of California Los Angeles — Plasma Wakefield Accelerator has been proven to be a promising technique to lower the cost of the future high energy colliders by offering orders of magnitude higher gradients than the conventional accelerators. However, it has been shown that ion motion is an important issue to account for in the extreme regime of ultra high intensities and ultra low emittances, characteristics of future high energy colliders. In this regime, the transverse electric field of the beam is so high that the plasma ions cannot be considered immobile at the time scale of electron plasma oscillations, thereby leading to a nonlinear focusing force. Therefore, the transverse emittance of a beam matched to the initial linear focusing will not be preserved under these circumstances. However, Vlasov equation predicts a matching profile even in the nonlinear regime. Furthermore, we extend the idea and introduce a plasma section that can match the entire beam to the mobile-ion regime of plasma. We also find the analytic solution for the optimal matching section. Simulation results will be presented.

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